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LASER-LIGHT SCATTERING AS A NEW METHOD FOR MEASURING PLATELET AGGREGATE FORMATION IN ARTERIES FOLLOWING BALLOON INJURY

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Since platelet function following balloon angioplasty is critical to clinical outcomes, this study was designed to evaluate a laser-light scattering technique to measure platelet aggregate formation following arterial wall injury. Platelet rich plasma (PRP) was obtained by centrifugation of whole blood collected from 10 dogs. Both carotid arteries (CAs) were removed after sacrifice and mounted in a perfusion chamber. Intimal injury to both CAs was induced using 3.0 mm balloons (three 60 sec. inflations). PRP was perfused through the CAs. A He-Ne laser beam was split and passed through cuvettes in the tubes draining the CAs. The scattering light, from the particles in the cuvettes, was spread on the diode array of a multichannel analyzer. From the angles of incidence, the ratio of scattering light at 1° to 5° represented the particle size distribution. Platelet aggregates were also measured by Coulter counter and compared to the laser method. Results by Coulter counter demonstrated that particle size increased from 29.9 ± 2 to 62.3 ± 7 μm^3 (mean ± SE); $p<0.0005$. Using laser-light scattering, angular light ratio increased from 114.4 ± 6 to 397.4 ± 60; $p<0.0004$. The correlation between the two methods was $r=0.77$; $p<0.005$. In conclusion, these data suggest that laser-light scattering correlates well with the Coulter counter method and has the advantage of continuous measurement of platelet aggregate formation. Laser-light scattering may be developed to assess platelet aggregate formation *in vivo* during drug delivery in interventional procedures.

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IN VITRO AND IN VIVO EFFECT OF SUB-ABLATIVE PULSED INFRARED LASER IRRADITION ON VASCULAR CELLS

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Background: Restenosis following coronary interventions may be attributed to proliferation and migration of smooth muscle cells into the intima. The purpose of the study was to determine the effect of low power (sub-ablative) infrared laser radiation on viability of vascular smooth muscle cells.

Methods: Confluent cultures of human aortic smooth muscle cells were irradiated with low power (260 millijoules, pulse duration 160 ns) infrared (1064 nm) radiation from ND-YAG laser (Alien Technology) transmitted via optical fiber. Normalized viability index (NVI) detected with nondestructive Alamar Blue assay and direct cell count were studied. Our experiments demonstrated cytotoxic effects of lower power infrared laser irradiation. NVI of irradiated cultures was 48.5±3.1/%. To evaluate the immediate impact of lower power infrared radiation on the vascular wall, 10 nonatherosclerotic rabbit aortas were subjected to intra-arterial irradiation via a fiberoptic through a 20 mm laser balloon. Immediately after laser irradiation, vessels were fixed in vivo at harvest with 10/%formalin at 80 mmHG, processed and stained with hematoxylin and eosin and Movat's. Histologic analysis revealed a highly acellular medial layer.

Conclusions: Low power sub-ablative pulsed infrared laser irradiation is cytotoxic to vascular smooth muscle cells and may contribute to reduction of myointimal hyperplasia.

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THROMBUS INTERACTION WITH MID-INFRARED LASER: LESSONS FROM MULTI CENTER STUDY

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Purpose: This study evaluated the application of mid-infrared laser angioplasty in the treatment of coronary artery lesions. The clinical results of laser-thrombus interaction were analyzed because of clinical relevance to the treatment of patients with ischemic heart syndromes.

Methods: Laser angioplasty (Ho:YAG, 2.1 micron, 5 Hz) was performed on 1,862 consecutive patients with a mean age of 61±11 years. Clinical indications included unstable angina (69%), stable angina (20%), acute infarction (6%), and positive exercise test (5%). Complex lesion morphology included eccentricity (62%), total occlusion (27%), long Lesions (14%), and saphenous vein grafts (11%). 30% of the target lesions contained coronary thrombus.

Results: 93% procedural success was achieved. The presence of *thrombus* within the target lesion was a predictor of *procedural success* (OR=2.0[95% confidence interval 2.0,4.0],p=.04). Bifurcation lesions (OR 0.5[95% confidence interval 0.2,1.0],p=.05) and severe tortuosity of the treated vessel (OR=0.4[95% confidence interval 0.2,0.9],p=.02) were identified as significant predictors of *decreased* laser success. Calcium within the lesion was associated with *reduced* procedural success (OR=0.57[95% confidence interval 0.34,0.97],p=.03). Complications included in-hospital bypass surgery (2.5%), Q-wave infarction (1.2%), and death (0.8%). Perforation occurred in (2.2%), major dissection in (5.8%), and spasm in (12%) of patients. Six-month angiographic restenosis was documented in 54% of patients.

Conclusions: The interaction between laser and thrombus predicts procedural success. As thrombus frequently presents in acute myocardial infarction and unstable angina the mid-infrared laser may be useful in selected patients with acute ischemic syndromes. No beneficial effects on reducing 6-month restenosis rates were observed.

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PERFORMANCE OF THE OPTIMALLY SPACED EXCIMER LASER CORONARY CATHETER

Rebecca Lippincott, William Kerker, Jerome Bellendir, Christopher Reiser. Spectranetics, Colorado Springs CO USA **Purpose:** To evaluate the physical characteristics and ablation efficacy of an optimally spaced (OS) multiple-optical-fiber catheter, in which the fiber-to-fiber spacing at the distal tip has been expanded so that fibers subtend the entire OS surface. Excimer laser catheter models currently in use ablate holes that are typically 45–55% of the catheter tip area. **Methods:** Benchtop testing (BT): OS and Vitesse Concentric (C) catheter tips were placed in contact with fresh porcine aorta in saline while XeCl 308nm laser energy ablated the tissue. The resulting hole diameter was microscopically measured for both catheter types. Dependent variables were fluence (mJ/mm^2), laser pulse repetition rate (Hz) and applied force. Porcine coronary model (PCM): The C and OS catheters were advanced over a guidewire and into the midportion of the left anterior descending branch (LAD), the major circumflex (Cx) branch and the right coronary artery (RCA). Radiopacity, ease of vascular access and tracking were scored on a 1 to 5 basis (1 = worst case and 5 = best case) according to the performance of each device. On additional porcine models, the laser system was activated at $50mJ/mm^2$ / 25Hz for 20 seconds while advancing the catheter at approximately 0.5–1.0mm per second through a straight segment of the LAD, Cx and RCA. **Results:** BT: At $60mJ/mm^2$/ 40Hz and 10gms applied force, the OS catheters ablated holes at least 20% larger than the C catheter. Hole diameter varied inversely with ablation rate (μm/pulse) and can be maximized with